PATENT ABSTRACTS OF JAPAN

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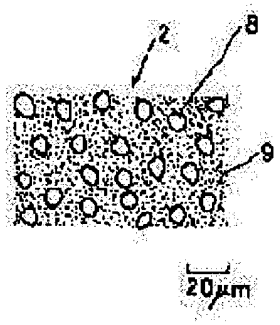
(72)Inventor : ENDO TOSHIYA

(54) TARGET FOR SPUTTERING

(57)Abstract:

PURPOSE: To prevent arcing which blocks sputtering on the surface of a target.

CONSTITUTION: When a mixture of an insulating material 8 with an electric conductive material 9 is sintered to obtain a target 2 for sputtering, the particle diameter of the insulating material 8 after sintering is regulating to ≤20μm. Arcing which blocks sputtering on the surface of the target 2 can be prevented and the risk of causing troubles by arcing such as defects due to foreign matter and the stop of electric discharge can be eliminated.



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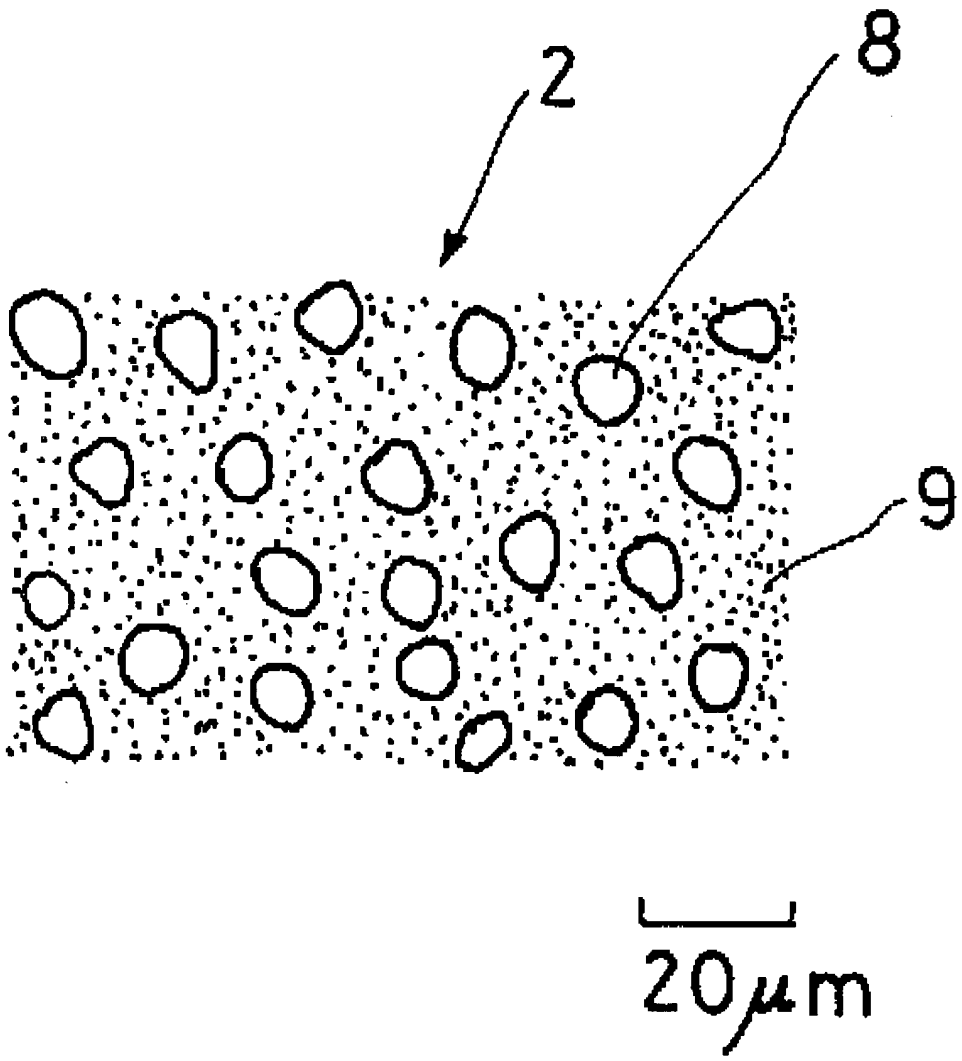
CLAIMS

[Claim(s)]
[Claim 1] The target for spatters characterized by setting particle size of said insulating matter after sintering to 20 micrometers or less in the target for spatters which comes to sinter the mixture of the insulating matter and the conductive matter.

[Translation done.]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the target for spatters, and relates to the target for spatters which comes especially to sinter the cermet which is the mixture of the insulating matter and the conductive matter.
[0002]
[Description of the Prior Art] First, drawing 4 explains the outline of an example of a sputtering system in which this kind of target for spatters is used.
[0003] The sputtering system of drawing 4 has the back up plate 1 arranged horizontally, and a target 2 is supported on this back up plate 1. Moreover, RF generator 3 is connected to this back up plate 1, and the high frequency current is supplied to the back up plate 1 by this RF generator 3. Furthermore, the magnet 4 for forming in the base of said back up plate 1 the magnetic field which intersects perpendicularly with the electric field by discharge is supported.
[0004] The counterelectrode 5 of the shape of casing which surrounds the periphery of this back up plate 1 is arranged in the periphery side of said back up plate 1, and edge section 5A faced near said target 2 is installed inside by this counterelectrode 5. Moreover, the substrate 6 is supported by the base of upper wall 5B of said counterelectrode 5 so that said target 2 may be countered. In addition, said counterelectrode 5 is grounded.
[0005] By supplying the high frequency current to the back up plate 1 by RF generator 3, by performing discharge between the back up plate 1 and edge section 5A of a counterelectrode 5, membrane formation to a substrate 6 will be performed and, according to such a configuration, the plasma 7 will stand above a target 2.
[0006] Thus, although membrane formation by the spatter was performed, the thing of a tantalum nitride system was put in practical use as an ingredient in the case of forming the exoergic resistor thin film of a thin film thermal head by the spatter.
[0007] However, buildup-ization of the electric resistance value of an exoergic resistor is needed from the commercial-scene demand of the formation of many dots of the thermal head in recent years. However, there was a limitation in increasing resistance using the exoergic resistor thin film of a tantalum nitride system. For this reason, in recent years, development of an ingredient new as an exoergic resistor thin film which can increase resistance is performed, and the cermet which is the generic name of the mixture of the insulating matter and the conductive matter as one of these attracts attention.
[0008] As this cermet, it is Ta-SiO2. A system and Cr-aluminum 2O3 The system etc. is developed. And the spatter of the sintered compact of a cermet will be carried out for membrane formation by such cermet ingredient.
[0009] By the way, although each powder raw material of the insulating matter and the conductive matter was generally mixed and calcinated in order to form the target 2 of the sintered compact of this cermet, such a powder raw material is so cheap that that mean particle diameter is large, and that

handling is also easy for it. On the other hand, in order to enlarge the consistency of said target 2, baking mentioned above has sintered the powder raw material of a cermet by the high voltage force and high temperature comparatively by the hotpress or the isotonic calcinating method. Consequently, the particle size of the insulating matter 8 in the target 2 which consists of a sintered compact of a cermet usually has magnitude of about 50-200 micrometers, as shown in drawing 5 . In addition, the sign 9 in drawing 5 is the conductive matter.

[0010]

[Problem(s) to be Solved by the Invention] When the spatter of the target 2 which consists of a sintered compact of the cermet mentioned above was carried out, there was a problem that abnormality discharge occurred frequently on the front face of a target 2.

[0011] If this abnormality discharge is explained still more concretely, the abnormality discharge called arcing will occur in surface 2A of the target 2 of the near part of E@JJI section 5A of the counterelectrode 5 grounded, and surface 2B of the target 2 of the part exposed to the plasma 7 of high density. It was accepted theory to generate, when the greatly different insulating matter 8 and the greatly different conductive matter 9 of an electrical property are intermingled on the front face of said target 2, and this arcing was an unescapable phenomenon in the spatter of the target 2 which consists of a sintered compact of a cermet.

[0012] That is, as for the plasma under spatter, it is desirable that it will be in a uniform condition over the whole region of the erosion field of a target 2. However, when the greatly different insulating matter 8 and the greatly different conductive matter 9 of an electrical property are intermingled on the front face of a target 2 like the sintered compact of the cermet mentioned above, as shown in drawing 6 , corresponding to it, the plasma 7 becomes an ununiformity. And turbulence of this plasma 7 serves as generating of arcing.

[0013] Moreover, irregularity will arise on the front face of a target 2 as membrane formation time amount passes, since the sputtering yields of the insulating matter 8 and the conductive matter 9 differ when the spatter of the sintered compact of a cermet is carried out. Usually, the way of the conductive matter 9 serves as the configuration where the insulating matter 8 projected from the insulating matter 8, as a sputtering yield shows the front face of the target 2 which is in membrane formation since it is large and which carried out the time amount activity to drawing 7 . Then, this projecting, insulating matter 8 will play the role of a lightning conductor, and arcing will occur.

[0014] And when arcing occurred, the poor foreign matter that the front face of a target 2 was heated locally, carried out melting and flight, and adhered to the substrate 6 which has countered arose, or the plasma became instability by arcing, and when the worst, there was a possibility that discharge might stop.

[0015] This design conquers the trouble mentioned above and aims at offering the target for spatters it was made for arcing which checks a spatter on the surface of a target not to produce.

[0016]

[Means for Solving the Problem] In order to attain the object mentioned above, the target for spatters of this invention is characterized by setting particle size of said insulating matter after sintering to 20 micrometers or less in the target for spatters which comes to sinter the mixture of the insulating matter and the conductive matter.

[0017]

[Function] Although making particle size of the insulating matter small prevents generating of arcing, since it became clear that effectiveness is size according to the experiment of this invention person According to this invention, by having set particle size of the insulating matter after sintering to 20 micrometers or less, arcing which checks a spatter on the surface of a target can be prevented from being generated, and a possibility that inconvenience called the poor foreign matter and discharge halt by generating of arcing may arise can be abolished.

[0018]

[Example] Hereafter, the example which shows this invention to a drawing explains.

[0019] Drawing 1 shows the example of the target 2 for spatters of this invention, and this target 2

sinters the mixture of the insulating matter 8 and the conductive matter 9, and is formed. And in this example, particle size after sintering of the insulating matter 8 is set to 20 micrometers or less.
[0020] In order to acquire the antecedent basis which sets particle size of this insulating matter 8 to 20 micrometers or less, this invention person conducted two kinds of following experiments.
[0021] First, four sorts of Ta-SiO2 of the following [the 1st experimental device] Although arcing occurred frequently in Targets C and D when the target (5"phi) of a system was manufactured, ArO.3Pa was performed for the controlled atmosphere, the spatter was performed for discharge power on the same conditions as RF500W and the generating condition of arcing was observed, in Targets A and B, it was unobservable.
[0022] 1) Target A : insulating matter SiO2 The particle-size two targets B of about 10 micrometers: Insulating matter SiO2 Particle-size of about 20 micrometers 3 target C: Insulating matter SiO2 Particle-size of about 100 micrometers 4 target D: Insulating matter SiO2 The particle size of about 100 micrometers again Two sorts of Ta-SiO2 of the following [the 2nd experimental device] Manufacture the rectangular target (5 "x20") of a system, and different equipment from the 1st experiment is used. ArO.7Pa was performed for the controlled atmosphere, the spatter was performed for discharge power on the same conditions as RF2000W, and the generating condition of arcing was observed. In this experimental device, it is easy to generate arcing from the 1st experiment mentioned above. According to this observation, arcing was satisfactory practically, although it generated very rarely in Target F. Moreover, in Target E, it was unobservable.
[0023] 1) Target E : insulating matter SiO2 The particle-size two targets F of about 10 micrometers: Insulating matter SiO2 As for the particle size of the insulating matter 8 in the target 2 from two sorts of these experimental results, it is desirable that it is 20 micrometers or less the particle size of about 20 micrometers.
[0024] And since the height of the projecting, insulating matter 8 which plays the role of a lightning conductor will become low as are shown in drawing 2 , and it is hard coming to generate arcing and is shown in drawing 3 , since turbulence of the plasma 7 decreases if the particle size of the insulating matter 8 in a target 2 is 20 micrometers or less and a minor diameter, it is hard coming to generate arcing also by this.
[0025] Therefore, there is no possibility that inconvenience called the poor foreign matter and repeatability degradation by generating of arcing may arise, and a spatter can be performed stably. Thereby, the stable production of the exoergic resistor thin film of a cermet system can be carried out, and it can respond to the commercial-scene demand of the formation of many dots of a thermal head.
[0026] In addition, this invention is not limited to the example mentioned above, and various modification is possible for it if needed.
[0027]
[Effect of the Invention] It can avoid producing arcing which checks a spatter on the surface of a target according to the target for spatters of this invention as explained above, and thereby, there is no possibility that inconvenience called the poor foreign matter and discharge halt by generating of arcing may arise, and a spatter can be performed stably.

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[0006] Thus, although membrane formation by the spatter was performed, the thing of a tantalum nitride system was put in practical use as an ingredient in the case of forming the exoergic resistor thin film of a thin film thermal head by the spatter.
[0007] However, buildup-ization of the electric resistance value of an exoergic resistor is needed from the commercial-scene demand of the formation of many dots of the thermal head in recent years. However, there was a limitation in increasing resistance using the exoergic resistor thin film of a tantalum nitride system. For this reason, in recent years, development of an ingredient new as an exoergic resistor thin film which can increase resistance is performed, and the cermet which is the generic name of the mixture of the insulating matter and the conductive matter as one of these attracts attention.
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[0009] By the way, although each powder raw material of the insulating matter and the conductive matter was generally mixed and calcinated in order to form the target 2 of the sintered compact of this cermet, such a powder raw material is so cheap that that mean particle diameter is large, and that

handling is also easy for it. On the other hand, in order to enlarge the consistency of said target 2, baking mentioned above has sintered the powder raw material of a cermet by the high voltage force and high temperature comparatively by the hotpress or the isotonic calcinating method. Consequently, the particle size of the insulating matter 8 in the target 2 which consists of a sintered compact of a cermet usually has magnitude of about 50-200 micrometers, as shown in drawing 5 . In addition, the sign 9 in drawing 5 is the conductive matter.

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[0025] Therefore, there is no possibility that inconvenience called the poor foreign matter and repeatability degradation by generating of arcing may arise, and a spatter can be performed stably. Thereby, the stable production of the exoergic resistor thin film of a cermet system can be carried out, and it can respond to the commercial-scene demand of the formation of many dots of a thermal head.
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TECHNICAL FIELD

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PRIOR ART

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[0003] The sputtering system of drawing 4 has the back up plate 1 arranged horizontally, and a target 2 is supported on this back up plate 1. Moreover, RF generator 3 is connected to this back up plate 1, and the high frequency current is supplied to the back up plate 1 by this RF generator 3. Furthermore, the magnet 4 for forming in the base of said back up plate 1 the magnetic field which intersects perpendicularly with the electric field by discharge is supported.
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EFFECT OF THE INVENTION

[Effect of the Invention] It can avoid producing arcing which checks a spatter on the surface of a target according to the target for spatters of this invention as explained above, and thereby, there is no possibility that inconvenience called the poor foreign matter and discharge halt by generating of arcing may arise, and a spatter can be performed stably.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When the spatter of the target 2 which consists of a sintered compact of the cermet mentioned above was carried out, there was a problem that abnormality discharge occurred frequently on the front face of a target 2.
[0011] If this abnormality discharge is explained still more concretely, the abnormality discharge called arcing will occur in surface 2A of the target 2 of the near part of E@JJI section 5A of the counterelectrode 5 grounded, and surface 2B of the target 2 of the part exposed to the plasma 7 of high density. It was accepted theory to generate, when the greatly different insulating matter 8 and the greatly different conductive matter 9 of an electrical property are intermingled on the front face of said target 2, and this arcing was an unescapable phenomenon in the spatter of the target 2 which consists of a sintered compact of a cermet.
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MEANS

[Means for Solving the Problem] In order to attain the object mentioned above, the target for spatters of this invention is characterized by setting particle size of said insulating matter after sintering to 20 micrometers or less in the target for spatters which comes to sinter the mixture of the insulating matter and the conductive matter.

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OPERATION

[Function] Although making particle size of the insulating matter small prevents generating of arcing, since it became clear that effectiveness is size according to the experiment of this invention person, according to this invention, particle size of the insulating matter after sintering was set to 20 micrometers or less, Arcing which checks a spatter on the surface of a target can be prevented from being generated, and a possibility that inconvenience called the poor foreign matter and discharge halt by generating of arcing may arise can be abolished.

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EXAMPLE

[Example] Hereafter, the example which shows this invention to a drawing explains.
[0019] Drawing 1 shows the example of the target 2 for spatters of this invention, and this target 2 sinters the mixture of the insulating matter 8 and the conductive matter 9, and is formed. And in this example, particle size after sintering of the insulating matter 8 is set to 20 micrometers or less.
[0020] In order to acquire the antecedent basis which sets particle size of this insulating matter 8 to 20 micrometers or less, this invention person conducted two kinds of following experiments.
[0021] First, four sorts of Ta-SiO2 of the following [the 1st experimental device] Although arcing occurred frequently in Targets C and D when the target (5"phi) of a system was manufactured, ArO.3Pa was performed for the controlled atmosphere, the spatter was performed for discharge power on the same conditions as RF500W and the generating condition of arcing was observed, in Targets A and B, it was unobservable.
[0022] 1) Target A : insulating matter SiO2 The particle-size two targets B of about 10 micrometers: Insulating matter SiO2 Particle-size of about 20 micrometers 3 target C: Insulating matter SiO2 Particle-size of about 100 micrometers 4 target D: Insulating matter SiO2 The particle size of about 100 micrometers again Two sorts of Ta-SiO2 of the following [the 2nd experimental device] Manufacture the rectangular target (5 "x20") of a system, and different equipment from the 1st experiment is used. ArO.7Pa was performed for the controlled atmosphere, the spatter was performed for discharge power on the same conditions as RF2000W, and the generating condition of arcing was observed. In this experimental device, it is easy to generate arcing from the 1st experiment mentioned above. According to this observation, arcing was satisfactory practically, although it generated very rarely in Target F. Moreover, in Target E, it was unobservable.
[0023] 1) Target E : insulating matter SiO2 The particle-size two targets F of about 10 micrometers: Insulating matter SiO2 As for the particle size of the insulating matter 8 in the target 2 from two sorts of these experimental results, it is desirable that it is 20 micrometers or less the particle size of about 20 micrometers.
[0024] And since the height of the projecting, insulating matter 8 which plays the role of a lightning conductor will become low as are shown in drawing 2 , and it is hard coming to generate arcing and is shown in drawing 3 , since turbulence of the plasma 7 decreases if the particle size of the insulating matter 8 in a target 2 is 20 micrometers or less and a minor diameter, it is hard coming to generate arcing also by this.
[0025] Therefore, there is no possibility that inconvenience called the poor foreign matter and repeatability degradation by generating of arcing may arise, and a spatter can be performed stably. Thereby, the stable production of the exoergic resistor thin film of a cermet system can be carried out, and it can respond to the commercial-scene demand of the formation of many dots of a thermal head.
[0026] In addition, this invention is not limited to the example mentioned above, and various modification is possible for it if needed.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline amplification top view of an important section showing the example of the target for spatters of this invention
[Drawing 2] The explanatory view showing an operation of the target for spatters of drawing 1
[Drawing 3] The explanatory view showing an operation of the target for spatters of drawing 1
[Drawing 4] The outline sectional view of the sputtering system with which the target for spatters is used
[Drawing 5] The outline amplification top view of an important section showing the conventional target for spatters
[Drawing 6] The explanatory view showing an operation of the target for spatters of drawing 5
[Drawing 7] The explanatory view showing an operation of the target for spatters of drawing 5
[Description of Notations]
1 Back Up Plate
2 Target
3 RF Generator
4 Magnet
5 Counterelectrode
6 Substrate
7 Plasma
8 Insulating Matter
9 Conductive Matter

[Translation done.]

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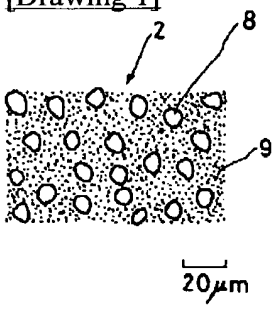
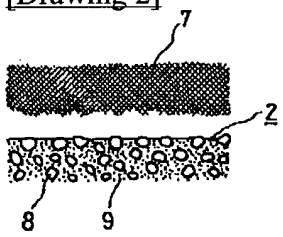
DRAWINGS

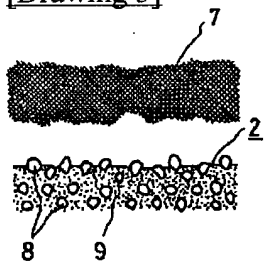
[Drawing 1]



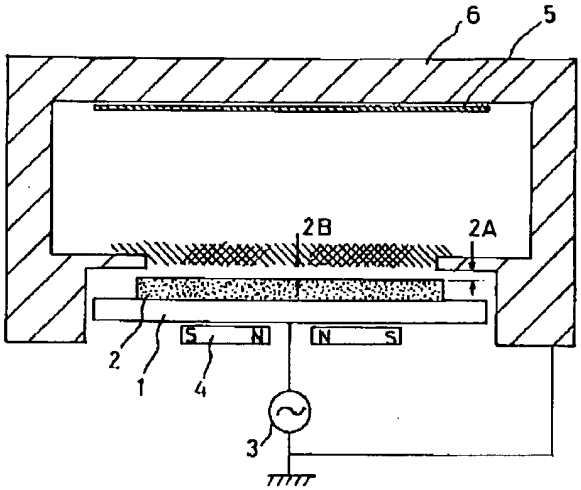
[Drawing 2]



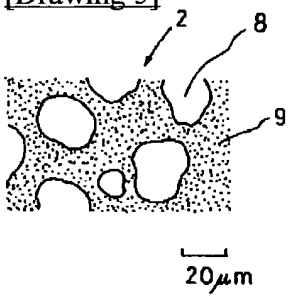
[Drawing 3]



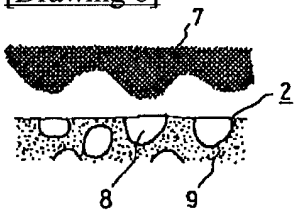
[Drawing 4]



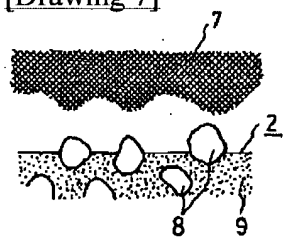
[Drawing 5]



[Drawing 6]



[Drawing 7]



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